

The Impact of Principal Leadership and Academic Supervision on the Success of Deep Learning in Public Elementary Schools in Tanjung Batu District

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Abstrak

Penelitian ini bertujuan untuk menganalisis pengaruh kepemimpinan kepala sekolah dan supervisi akademik terhadap keberhasilan deep learning di SD Negeri Kecamatan Tanjung Batu. Penelitian menggunakan pendekatan kuantitatif korelasional dengan instrumen angket skala Likert yang diberikan kepada guru dan kepala sekolah. Hasil penelitian menunjukkan bahwa kepemimpinan kepala sekolah dan supervisi akademik berpengaruh positif dan signifikan terhadap keberhasilan deep learning. Kepemimpinan yang visioner, komunikatif, dan inovatif mampu menciptakan iklim belajar yang kondusif serta mendorong praktik pembelajaran reflektif dan bermakna. Supervisi akademik yang terstruktur melalui observasi kelas, pemberian umpan balik, dan tindak lanjut coaching juga meningkatkan kemampuan guru dalam mengembangkan pemahaman konseptual siswa. Secara simultan, kedua variabel menjelaskan 48% variasi keberhasilan deep learning, sedangkan sisanya dipengaruhi faktor lain seperti budaya sekolah, sarana prasarana, motivasi guru, dan kesiapan teknologi. Penelitian ini menegaskan pentingnya kepemimpinan dan supervisi yang berkelanjutan untuk mendukung pembelajaran bermakna di sekolah dasar.

Kata kunci: Kepemimpinan kepala sekolah, supervisi akademik, pembelajaran mendalam, sekolah dasar

Abstract

This study examined the influence of principal leadership and academic supervision on the success of deep learning in public elementary schools in Tanjung Batu District. Employing a quantitative correlational design, data were collected through Likert-scale questionnaires administered to teachers and principals. The findings revealed that principal leadership and academic supervision both had positive and significant effects on deep learning implementation. Visionary, communicative, and innovation-oriented leadership contributed to creating a supportive learning climate that encouraged reflective and meaningful learning practices. Likewise, structured academic supervision through classroom observations, feedback, and follow-up coaching enhanced teachers' capacity to promote conceptual understanding rather than rote memorization. Simultaneously, both variables explained 48% of the variance in deep learning success, indicating that other factors such as school culture, infrastructure, teacher motivation, and technological readiness also play important roles. The study highlights the need for integrated leadership practices, continuous supervision, and systemic support to sustain deep learning in elementary education.

Keywords: Principal leadership, academic supervision, deep learning, elementary school

1. INTRODUCTION

Elementary education holds a fundamental role in shaping students' academic competence, social skills, and character. In the era of globalization and the Fourth Industrial Revolution, learning is required not only to emphasize the mastery of factual knowledge but also to foster deep understanding and critical thinking skills. The concept of deep learning refers to a learning process that enables students to connect knowledge with real-life situations, develop critical thinking and reflection, and apply concepts meaningfully. Deep learning

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focuses on students' ability to understand the meaning behind what they learn, rather than merely memorizing information, thus fostering more sustainable and meaningful learning outcomes.

The success of deep learning largely depends on the quality of school management, particularly through the role of the principal and the effectiveness of the academic supervision system. As the leader of the school, the principal holds a strategic position in formulating the school's learning vision, creating a supportive learning culture, and guiding teachers' professional growth. Research indicates that principals who actively engage in supervision and instructional management can enhance teacher performance and classroom effectiveness (Hidayat et al., 2024). Visionary leadership also encourages the creation of innovative learning practices and a positive school climate conducive to the implementation of deep learning.

Moreover, academic supervision carried out by the principal has been proven to contribute positively to improving teaching quality and teacher professionalism. Academic supervision is not merely an evaluation process but also a continuous form of professional guidance that helps teachers improve the quality of their instructional practices. Fadillah and Rahmawati (2023) found that well-planned academic supervision can enhance teachers' motivation and performance through mentoring, evaluation, and follow-up actions. Therefore, academic supervision plays a vital role in ensuring that deep learning is implemented in alignment with the goals of education.

However, there remains a research gap that empirically connects the two variables principal leadership and academic supervision with the success of deep learning at the elementary school level, particularly in specific contexts such as Tanjung Batu District. Most previous studies have focused on the influence of principal leadership on teacher performance or general school quality, without specifically examining the concept of deep learning, which emphasizes students' conceptual and reflective understanding. Consequently, this study aims to fill that gap by empirically examining the relationship between principal leadership and academic supervision on the success of deep learning in public elementary schools.

Although various studies have shown that school leadership and academic supervision significantly influence teaching quality and teacher performance, research that specifically examines their relationship with the success of deep learning at the elementary level remains scarce. For example, Wulandari, Ginting, and Prayito (2023) found that academic supervision and leadership style have a strong impact on primary school quality but did not focus explicitly on deep learning. In addition, Noor et al. (2020) revealed that the implementation of academic supervision in Indonesia often faces challenges such as administrative burdens and time constraints, which limit principals' ability to optimally support learning innovation. These conditions highlight the need for further empirical research on the influence of principal leadership and academic supervision on the success of deep learning in public elementary schools across Tanjung Batu District.

Principal leadership is a crucial factor in educational management that influences the learning environment, teacher behavior, and student achievement. As Fauzan (2024) stated, "Principal leadership has been proven to significantly affect teacher performance, including

the ability to mobilize school resources effectively and create a supportive working environment.”

Quantitative studies on elementary school teachers have shown a positive influence of principal leadership on teachers’ motivation and performance. For example, Hardono, Haryono, and Yusuf (2017) in *Educational Management* found that principal leadership significantly affects teachers’ motivation and job performance.

Therefore, in the context of this study, principal leadership is defined as the leadership style and behavior demonstrated by the principal in determining school policy direction, managing teachers, shaping the school climate, and facilitating instructional innovation.

Academic supervision is a form of professional coaching for teachers conducted by principals or supervisors with the aim of improving the quality of learning. A study highlighted that “principals play an essential role in curriculum development, quality improvement, school progress, the application of teaching methods and techniques, and fostering an integrated learning environment” through academic supervision.

According to Taufik and Sauri (2025), academic supervision that is collaboratively planned, reflectively implemented, and systematically evaluated contributes significantly to teachers’ professional development. Furthermore, other research findings show that effective academic supervision which includes the stages of planning, implementation, evaluation, and follow-up has a positive impact on educational quality.

For instance, a study conducted in Purwakarta Regency concluded that principal academic supervision had a significant positive influence of 30.9% on educational quality. In this study, academic supervision refers to all supervisory activities conducted by the principal toward teachers, including classroom observation, mentoring, evaluation, and follow-up actions to improve the learning process.

Deep learning is a learning approach that emphasizes a conscious, meaningful, and engaging learning process, allowing students to develop critical thinking, creativity, and collaboration skills. The Ministry of Education and Culture of Indonesia officially defines deep learning as “an approach that upholds meaningful learning by creating a conscious, joyful, and reflective learning atmosphere through holistic and integrated cultivation of thought, heart, feeling, and body.” Deep learning enables students to “develop critical, creative, and collaborative thinking skills while providing opportunities to maximize their potential.” Within the framework of this study, the success of deep learning is defined as the achievement of a learning process that enables students not only to master content but also to connect it to real-life situations, think reflectively, and apply knowledge in everyday life.

Based on the literature review above, the conceptual framework of this study can be described as follows:

1. The style and quality of principal leadership (X_1) can create a school climate that supports the implementation of academic supervision (X_2) and innovative learning practices.

2. Academic supervision (X_2), when effectively carried out by the principal, can strengthen teachers' capacity to implement deep learning (Y).
3. Therefore, both X_1 and X_2 are expected to have a simultaneous influence on Y.

Research Hypotheses:

1. H_1 : Principal leadership (X_1) has a positive influence on the success of deep learning (Y).
2. H_2 : Academic supervision (X_2) has a positive influence on the success of deep learning (Y).
3. H_3 : Principal leadership (X_1) and academic supervision (X_2) simultaneously have a positive influence on the success of deep learning (Y).

2. METHOD

Research Design

This study employed a quantitative correlational approach aimed at measuring the influence of two independent variables principal leadership (X_1) and academic supervision (X_2) on the dependent variable, namely the success of deep learning (Y). The correlational design was chosen to examine the relationships among variables simultaneously within the context of elementary schools. As stated in the literature, quantitative research seeks to “develop mathematical models, theories, and hypotheses related to a phenomenon” (Ibnu Rusyd, 2022). The primary research instrument used was a Likert-scale questionnaire, which was statistically analyzed using multiple linear regression to determine the strength and direction of the relationships among the variables.

Time and Research Setting

The research was conducted during the even semester of the 2025/2026 academic year at several public elementary schools (SD Negeri) located in the Tanjung Batu District. The selection of the time frame and location was intended to ensure that the results would be representative and relevant to the actual conditions of elementary schools in the area. The implementation period covered several stages, including instrument preparation, data collection, and data analysis, over a duration of approximately 8-10 weeks.

Participants

The population of this study consisted of all classroom teachers and principals from public elementary schools in Tanjung Batu District. The sampling technique used was purposive sampling, which involved selecting schools that met specific criteria such as being established for at least five years, implementing the latest national curriculum, and having digital learning facilities.

From this population, a sample of approximately 50 teachers and 4 principals was selected to complete the research instruments. This technique aligns with the principles of

quantitative sampling, which emphasize that the unit of analysis should be sufficiently large to explain the variance among variables (Marinu Waruwu et al., 2025).

Data Collection Techniques

Data were collected using several methods as follows:

1. Questionnaire: Used to measure teachers' perceptions of the principal's leadership style, the implementation of academic supervision, and the perceived success of deep learning in classrooms.
2. Documentation: Involved collecting lesson plans, classroom observation results, report cards, and other relevant school records as secondary data.
3. Short Interviews: Conducted with principals and selected teachers to obtain qualitative insights that support quantitative findings.

The questionnaire items were developed based on indicators derived from previous research, including indicators of instructional leadership, academic supervision, and deep learning.

Data Analysis Techniques

Before inferential analysis, the data were first tested for instrument validity and reliability using Cronbach's alpha. Descriptive statistical analyses including mean, standard deviation, and frequency distribution were performed to describe the general characteristics of the research variables.

To examine the influence of the independent variables on the dependent variable, multiple linear regression analysis was applied for simultaneous testing, while the t-test was used for partial analysis. A significance level of $p < 0.05$ was adopted as the threshold for hypothesis acceptance or rejection. This type of quantitative data analysis is consistent with the procedures of quantitative research methodology, which utilize numerical data to determine relationships and the strength of influence among variables.

3. RESULT AND DISCUSSION

Descriptive Analysis Results

Based on the quantitative correlational design described in the method section, the descriptive statistical analysis was conducted to provide an overview of teachers' perceptions regarding principal leadership (X_1), academic supervision (X_2), and the success of deep learning (Y). The results indicate that principal leadership obtained a mean score of 3.80 on a 5-point Likert scale, which falls into the high category. This suggests that teachers generally perceive their principals as demonstrating effective leadership practices, including instructional guidance, professional support, and decision-making involvement.

Academic supervision (X_2) recorded a mean score of 3.70, also categorized as high. This indicates that supervision activities such as classroom observation, constructive

feedback, mentoring, and follow-up discussions are perceived as being implemented adequately and systematically.

Meanwhile, the success of deep learning (Y), measured through indicators such as students' conceptual understanding, active engagement, higher-order thinking, and application of knowledge in authentic contexts, achieved a mean score of 3.65. Although slightly lower than X_1 and X_2 , the score remains within the high category, suggesting that deep learning practices are reasonably well implemented in the observed schools.

Overall, these descriptive findings indicate that the research setting provides a relatively supportive environment for instructional improvement and deep learning implementation, aligning with the quantitative objective of identifying relationships among the three variables.

Inferential Analysis Results

Following instrument validity and reliability testing using Cronbach's alpha (as described in the methodology), multiple linear regression analysis was conducted to examine both partial and simultaneous influences of the independent variables on the dependent variable. The use of regression analysis is consistent with the correlational quantitative design aimed at measuring predictive relationships among variables.

1. Influence of Principal Leadership (X_1) on Deep Learning (Y)

The regression analysis revealed that principal leadership had a positive and statistically significant influence on the success of deep learning, with a regression coefficient of $\beta = 0.42$ and $p < 0.05$. This means that every one-unit increase in the principal leadership score corresponds to a 0.42 increase in the deep learning score, assuming other variables remain constant.

This result confirms Hypothesis 1 (H_1), indicating that stronger leadership practices are associated with improved implementation of deep learning. In line with the research design, this finding demonstrates a meaningful predictive relationship between X_1 and Y within the sampled elementary schools.

3. Influence of Academic Supervision (X_2) on Deep Learning (Y)

Similarly, academic supervision showed a positive and statistically significant influence on deep learning, with $\beta = 0.35$ and $p < 0.05$. This result supports Hypothesis 2 (H_2), meaning that effective supervision contributes significantly to teachers' ability to implement deep learning strategies. Although the coefficient value is slightly lower than that of principal leadership, it still indicates a substantial contribution. This aligns with the theoretical assumption in the conceptual framework that supervision operationalizes instructional improvement through direct pedagogical guidance.

4. Simultaneous Influence of X_1 and X_2 on Y

The simultaneous test using multiple regression analysis revealed that principal leadership and academic supervision together explained 48% ($R^2 = 0.48$) of the variance in the success of deep learning. This result confirms Hypothesis 3 (H_3), indicating that both variables collectively have a significant influence on deep learning outcomes.

An R^2 value of 0.48 suggests a moderately strong explanatory power in educational research contexts. However, the remaining 52% of variance indicates that other factors such as teacher competence, student characteristics, school facilities, organizational culture, and external policy influences may also contribute to the success of deep learning but were not included in this study.

Discussion

The findings of this study indicate that a visionary, communicative, and innovation-oriented leadership style significantly influences the success of deep learning in public elementary schools in Tanjung Batu District. This reinforces the view that school leadership is not merely administrative but fundamentally instructional in nature. According to Philip Hallinger (2022), instructional leadership directly affects teaching quality and student learning by focusing on curriculum, supervision, and teacher development. Similarly, Kenneth Leithwood, Harris, and Hopkins (2021) emphasize that successful school leadership contributes to student outcomes through setting directions, developing people, and redesigning the organization. The present findings align with Aslam et al. (2021) and Fauzan et al. (2024), who found that principals' instructional leadership significantly improves teacher performance. In addition, Bush (2022) explains that effective educational leadership integrates vision, strategic direction, and participative management, which collectively foster a positive school climate conducive to meaningful learning.

The significant influence of academic supervision on deep learning success further confirms that supervision is a strategic instrument for improving instructional quality. Supervision practices such as classroom observation, constructive feedback, and follow-up coaching enhance teachers' pedagogical competence and reflective capacity. This finding supports Noor et al. (2020), who state that structured academic supervision strengthens teachers' professional practice and instructional consistency. Likewise, Supriadi (2022) and Yosepty et al. (2024) emphasize that academic supervision plays a crucial role in improving teacher professionalism in planning, implementing, and evaluating instruction. Recent studies by Taufik and Sauri (2025) and Wardani et al. (2025) also demonstrate that optimized supervision significantly contributes to teacher performance and learning effectiveness. These findings are consistent with Darling-Hammond, Hyler, and Gardner (2022), who argue that sustained, feedback-based professional development is essential for improving teaching quality and fostering deeper student learning.

Although principal leadership and academic supervision significantly contributed to deep learning success, the model explained 48% of the variance, indicating that other factors also play important roles. This finding is consistent with broader educational research highlighting

the influence of systemic and contextual variables. For instance, the OECD (2023) report emphasizes that school quality is shaped not only by leadership but also by infrastructure, teacher capacity, and policy alignment. Similarly, the World Bank (2023) stresses that learning recovery and sustainable education reform require integrated strategies involving leadership, teacher competence, and resource management. Getie (2020) further notes that teacher and student motivation significantly influence learning outcomes, while Simatupang and Arneti (2024) highlight the importance of strategic planning in improving school quality. These perspectives indicate that deep learning is a multidimensional construct influenced by leadership, supervision, organizational culture, and systemic readiness.

From a practical standpoint, the results suggest that principals in Tanjung Batu District should strengthen instructional leadership practices by articulating a clear vision for deep learning, fostering collaboration, and ensuring consistent professional support. Pont (2022) emphasizes that school leadership for learning requires coherence between vision, supervision, and teacher development. Moreover, Robinson, Lloyd, and Rowe (2021) confirm that leadership practices focused directly on teaching and learning have the strongest impact on student outcomes. Therefore, academic supervision should be implemented systematically and continuously rather than as a procedural formality. Wulandari et al. (2023) and Luturlean et al. (2023) also demonstrate that the synergy between leadership style and supervision significantly improves school quality and teacher effectiveness.

In conclusion, this study strengthens contemporary leadership theory by empirically confirming that instructional leadership and academic supervision are critical drivers of deep learning success in elementary schools. However, sustainable implementation requires an integrated approach that combines visionary leadership, structured supervision, strategic planning, teacher professional development, and systemic support. These findings are consistent with contemporary perspectives on educational leadership and reform, which position principals as key agents in improving instructional quality and student learning outcomes.

4. CONCLUSION

This study shows that visionary, communicative, and innovation-oriented leadership styles significantly enhance deep learning in elementary schools in Tanjung Batu District. Effective leadership goes beyond administration, creating a supportive learning environment and motivating teachers to adopt innovative practices. Academic supervision through regular classroom observations, feedback, and coaching also plays a crucial role in improving teaching and learning outcomes. However, other factors like school culture, infrastructure, teacher motivation, and technological readiness contribute 52% of the variance in deep learning success.

Practical implications suggest that principals should focus on strengthening leadership practices and implementing continuous academic supervision. Systemic support, including teacher training and ongoing evaluation, is necessary for sustainable improvement. Despite these contributions, the study's limitations include the exclusion of other influential factors, such as technology and teacher motivation. Future research should explore these factors,

expand the sample to other regions, and investigate the long-term effects of leadership and supervision on deep learning.

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